



Interest Rate Futures

Chapter 6

Day Count Conventions in the U.S. (Page 129)

Treasury Bonds: Actual/Actual
(in period)

Corporate Bonds: 30/360

Money Market Actual/360
Instruments:

Treasury Bond Price Quotes in the U.S

$$\text{Cash price} = \text{Quoted price} + \text{Accrued Interest}$$

Treasury Bond Futures

Pages 132-136

Cash price received by party with short position =

Most recent settlement price ×
Conversion factor + Accrued interest

Example

- Most recent settlement price = 90.00
- Conversion factor of bond delivered = 1.3800
- Accrued interest on bond = 3.00
- Price received for bond is
 $1.3800 \times 90.00 + 3.00 = \127.20
per \$100 of principal

Conversion Factor

The conversion factor for a bond is approximately equal to the value of the bond on the assumption that the yield curve is flat at 6% with semiannual compounding

CBOT

T-Bonds & T-Notes

Factors that affect the futures price:

- Delivery can be made any time during the delivery month
- Any of a range of eligible bonds can be delivered
- The wild card play

Eurodollar Futures (Page 136-141)

- A Eurodollar is a dollar deposited in a bank outside the United States
- Eurodollar futures are futures on the 3-month Eurodollar deposit rate (same as 3-month LIBOR rate)
- One contract is on the rate earned on \$1 million
- A change of one basis point or 0.01 in a Eurodollar futures quote corresponds to a contract price change of \$25

Eurodollar Futures continued

- A Eurodollar futures contract is settled in cash
- When it expires (on the third Wednesday of the delivery month) the final settlement price is 100 minus the actual three month deposit rate

Example

- Suppose you buy (take a long position in) a contract on November 1
- The contract expires on December 21
- The prices are as shown
- How much do you gain or lose a) on the first day, b) on the second day, c) over the whole time until expiration?

Example

Date	Quote
Nov 1	97.12
Nov 2	97.23
Nov 3	96.98
.....	
Dec 21	97.42

Example continued

- If on Nov. 1 you know that you will have \$1 million to invest on for three months on Dec 21, the contract locks in a rate of

$$100 - 97.12 = 2.88\%$$

- In the example you earn $100 - 97.42 = 2.58\%$ on \$1 million for three months ($=\$6,450$) and make a gain day by day on the futures contract of $30 \times \$25 = \750

Formula for Contract Value (page 138)

If Q is the quoted price of a Eurodollar futures contract, the value of one contract is $10,000[100 - 0.25(100 - Q)]$

Forward Rates and Eurodollar Futures (Page 139-142)

- Eurodollar futures contracts last as long as 10 years
- For Eurodollar futures lasting beyond two years we cannot assume that the forward rate equals the futures rate

There are Two Reasons

- Futures is settled daily where forward is settled once
- Futures is settled at the beginning of the underlying three-month period; FRA is settled at the end of the underlying three-month period

Forward Rates and Eurodollar Futures continued

- A convexity adjustment often made is
$$\text{Forward Rate} = \text{Futures Rate} - 0.5\sigma^2 T_1 T_2$$
- T_1 is the time to maturity of the forward contract
- T_2 is the time to maturity of the rate underlying the forward contract (90 days later than T_1)
- σ is the standard deviation of the short rate (typically about 1.2%)

Convexity Adjustment when $\sigma=0.012$ (page 140)

Maturity of Futures	Convexity Adjustment (bps)
2	3.2
4	12.2
6	27.0
8	47.5
10	73.8

Extending the LIBOR Zero Curve

- LIBOR deposit rates define the LIBOR zero curve out to one year
- Eurodollar futures can be used to determine forward rates and the forward rates can then be used to bootstrap the zero curve

Example (page 141-142)

$$F = \frac{R_2 T_2 - R_1 T_1}{T_2 - T_1}$$

so that

$$R_2 = \frac{F(T_2 - T_1) + R_1 T_1}{T_2}$$

If the 400 day LIBOR rate has been calculated as 4.80% and the forward rate for the period between 400 and 491 days is 5.30 the 491 day rate is 4.893%

Duration Matching

- This involves hedging against interest rate risk by matching the durations of assets and liabilities
- It provides protection against small parallel shifts in the zero curve

Use of Eurodollar Futures

- One contract locks in an interest rate on \$1 million for a future 3-month period
- How many contracts are necessary to lock in an interest rate on \$1 million for a future six-month period?

Duration-Based Hedge Ratio

$$\frac{PD_P}{F_C D_F}$$

F_C Contract price for interest rate futures

D_F Duration of asset underlying futures at maturity

P Value of portfolio being hedged

D_P Duration of portfolio at hedge maturity

Example

- It is August. A fund manager has \$10 million invested in a portfolio of government bonds with a duration of 6.80 years and wants to hedge against interest rate moves between August and December
- The manager decides to use December T-bond futures. The futures price is 93-02 or 93.0625 and the duration of the cheapest to deliver bond is 9.2 years
- The number of contracts that should be shorted is
$$\frac{10,000,000}{93.0625} \times \frac{6.80}{9.20} = 79$$

Limitations of Duration-Based Hedging

- Assumes that only parallel shift in yield curve take place
- Assumes that yield curve changes are small
- When T-Bond futures is used assumes there will be no change in the cheapest-to-deliver bond

GAP Management (Business Snapshot 6.3)

This is a more sophisticated approach used by banks to hedge interest rate. It involves

- Bucketing the zero curve
- Hedging exposure to situation where rates corresponding to one bucket change and all other rates stay the same